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Relationship between Femoroacetabular Impingement and Pubalgia in Professional Soccer Players

Relação do impacto femoroacetabular e pubalgia em jogadores profissionais de futebol de campo

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Abstract

Objective To analyze the relationship between pubalgia and femoroacetabular impingement (FAI) in professional athletes of a soccer club, defining the prevalence of these conditions in the sample studied.

Methods It is an epidemiological, cross-sectional, and analytical study including 90 professional soccer players active from 2019 to 2021. We accessed the medical records of the subjects to retrieve information from the modified Pre-Competition Medical Assessment (PCMA) protocol, orthopedic physical examination, and anteroposterior pelvic radiographs to assess pubalgia and FAI, respectively. Inclusion criteria were athletes playing in the professional soccer club in the 2019 to 2021 season, who underwent a modified PCMA upon admission, and who signed an informed consent form.

Results FAI was highly prevalent (85.6%) in the sample. This prevalence may occur because, in Brazil, people start playing sports early, not always in suitable fields, or with no proper equipment and supervision. In addition, the CAM-type impingement was the most frequent (62.2%). These injuries are related to high-intensity movements, including those associated with soccer. Furthermore, there is no dependency correlation between pubalgia and FAI. FAI was present in only 20% of athletes with pubalgia complaints.

Conclusion There was a high prevalence of FAI in professional soccer players in the studied population (85.6%) but with no relationship between FAI and pubalgia.

Keywords
- athletes
- femoroacetabular impingement
- pubic bone
- soccer

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Resumo

Objetivo Analisar a relação entre a pubalgia e o impacto femoroacetabular (IFA) em atletas profissionais de um clube de futebol, definindo a prevalência de pubalgia e de impacto femoroacetabular na casuística estudada.

Métodos É um estudo epidemiológico, transversal e analítico. Foram selecionados 90 atletas profissionais de futebol atuantes no período de 2019-2021. Foram acessados os prontuários para obtenção do protocolo PCMA modificado, além de exame físico ortopédico e de radiografias da bacia com incidência anteroposterior para avaliação de pubalgia e IFA, respectivamente. Critérios de Inclusão: Atletas que atuaram no clube de futebol de campo profissional na temporada de 2019 a 2021, que foram submetidos a aplicação do PCMA modificado na admissão e que assinaram o TCLE.

Resultados O IFA apresentou elevada prevalência na amostra (85.6%), o que pode ocorrer pois, no Brasil, os jovens iniciam a prática esportiva em idade muito precoce, além do fato de os jogadores nem sempre praticarem o esporte em campos adequados ou com equipamentos e supervisão adequada. Ademais, o impacto tipo CAM foi o mais frequente (62.2%). O surgimento dessas lesões é relacionado a movimentos de alta intensidade, como os vistos no futebol. Outrossim, observou-se que não há correlação de dependência entre a pubalgia e o IFA. Foi visto que o IFA estava presente em apenas 20% dos atletas queixosos de pubalgia.

Conclusão Há elevada prevalência de IFA em atletas de futebol profissional na população estudada (85.6%) e não houve relação entre o IFA e a presença de pubalgia.

Palavras-chave
- atletas
- futebol
- impacto femoroacetabular
- osso púbico

Introduction

Femoroacetabular impingement (FAI) is the most common cause of hip pain. FAI results from an anomalous contact between the proximal end of the femur and the acetabular margin due to the abnormal development of these structures. It is attributed to genetic factors and the practice of intense physical activity, culminating in the lesions in the labrum and acetabular cartilage, which, in long-term, transform into degenerative hip diseases, mainly in young patients.[1,2]

There are two mechanisms described for FAI development. The first mechanism consists of CAM-type impingement, in which the patient presents a non-spherical femoral head or a decreased displacement between the femoral head and neck; in this case, the impingement area is in the anterolateral portion of the femoral head-neck junction. The second mechanism is pincer-type impingement, characterized by a cartilage abnormality, an anterosuperior labral lesion, and acetabular over coverage with an increased anterior wall. There is also a mixed type in which both mechanisms coexist.[3]

FAI prevalence is higher in the athletic population, especially in sports involving intense physical exertion, such as soccer. There are reports that morphological alterations from CAM-type FAI affect about 60% of professional soccer players, representing a high prevalence in this population.[4]

The influence of sports on FAI development, resulting in athlete pubalgia, has been recognized. This involvement is frequent in young adults who practice exercises requiring repetitive hip movements, including flexion and internal rotation, as in soccer. This condition debilitates the subject, limiting the athletic performance due to pain, and, in the long term, leads to the early occurrence of osteoarthritis and retirement from professional football.[1,2,5]

In athletes, pubalgia usually appears after skeletal maturity. Pain is intense, may be insidious or sudden, and worsens during the execution of squats, cuts, and pivot movements. This fact explains the high incidence in this specific population. Athletes have a greater risk of hip injuries due to excessive, high-intensity, repetitive movements favoring intra- and extra-articular micro-injuries. Furthermore, mechanical signs such as pain, stiffness, and reduced hip amplitude, mainly in flexion and rotation, are common symptoms in athletes.[6]

This pain is related to physical activity and usually resolves with rest. Withdrawal from activities can solve the symptoms, but recurrence when resuming sports practices is characteristic of this syndrome. Such factors can lead to FAI-related chronic hip pain, reducing the athlete's performance.[1,6,7]

In addition, adolescents participating in high-impact sports with extreme hip movements are more likely to develop FAI. Physical activity during the bone growth period is associated with a higher risk of CAM-type FAI, potentially related to physeal abnormalities.[3]

This study aimed to evaluate the prevalence of FAI in professional soccer athletes and its relationship with pubalgia.

Materials and Methods

This project began after approval by the Ethics Committee, CAAE number 52795020.7.0000.5174, respecting Resolution

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number 466/12 of the Brazilian National Health Council (CNS, for its acronym in Portuguese) and the Nuremberg and Helsinki principles.

This is an epidemiological, cross-sectional, and analytical study. It included 90 professional soccer players working in a professional soccer club from 2019 to 2021, who, by signing an informed consent form (ICF), voluntarily accepted to participate in this study.

Inclusion criteria were athletes playing in the professional field soccer club during the 2019-2021 season, who underwent a modified PCMA upon admission and signed the ICF. The following subjects were excluded from the study: those who did not show up for data collection, who did not sign or partially agree with the ICG, who did not fully respond to the question form, or who did not participate in competitions during the 2019-2021 season.

The data collection process encompassed three stages. First, participants signing the ICF received a clear, objective explanation of the project. Next, we applied the modified PCMA protocol, which is used for admitting professional athletes. This protocol has clinical, laboratory, and radiographic criteria to evaluate the athlete's general condition, emphasizing orthopedics. We obtained these data by accessing these patients' medical records and performing anamnesis and orthopedic physical examinations.

Furthermore, we requested anteroposterior (AP) pelvic radiographs to determine the CAM-type impingement using the following measures: an alpha angle above 55° and pistol grip deformity (index - head). PINCER-type impingement determination used the following measurements: Tönnis angle lower than 0° and center lateral edge angle (Wiberg angle) higher than 40°; both angles indicate acetabular over coverage.8

Data collection, filling out the modified PCMA protocol, radiographs, and orthopedic physical examination occurred on an outpatient basis. We selected the following data: dominance, position, body mass index (BMI), Tredelenburg sign, and pain symptoms on coxofemoral joints. Then, we inserted the data in the online platform Google Forms (Google Forms) to create tables.

Results

The sample consisted of 90 athletes aged 17 to 38 years old with an arithmetic average age of 26. The age group with the highest proportion was 25 to 29 (34.4%), followed by 20 to 24 (28.9%).

Regarding dominance, the statistically significant majority ($^*p < 0.0001$) of athletes were right-handed (61.1%). BMI calculation showed a statistically significant proportion ($^*p < 0.0001$) of athletes with adequate weight (73.3%).

The significant majority ($^*p = 0.0018$) of the evaluated athletes play in the midfield position (40.0%), followed by attackers (8.9%). The athletes played in a minimum of six and a maximum of 60 matches, with an average of 26 matches within the last year, as shown in ►**Figs. 1** and **2**.

The Trendelenburg sign was positive in a statistically significant proportion ($^*p = 0.0002$) of players (70.0%). Among athletes with a positive result, the highest proportion had it on both sides of the hip (58.8%), followed by those with a positive sign on the left side only (33.3%), as shown in ►**Table 1**.

Twenty-two players (24.4%) had pubalgia. The diagnosis was established on clinical tests, considering the following positive signs: pain on groin palpation, in the adductor musculature, or Grava test in any combination (►**Fig. 3**).

FAI was statistically significantly present ($^*p < 0.0001$) in the studied sample (85.6%). The CAM-type impingement was the most frequent (62.2%), with a statistical significance ($^*p < 0.0001$) compared with the PINCER type (4.4%) and the mixed type (18.9%).

A significant proportion ($^*p < 0.0001$) of FAI cases presented an impingement in the alpha angle (80.0%). The Tönnis angle had the second highest proportion of impingement (23.3%), and no player had an impingement on the Wiberg angle, as shown in ►**Fig. 4**.

Eleven athletes (12.2%) presented a pistol grip deformity, as shown in ►**Table 2** and ►**Fig. 5**.

The comparison to verify the dependence between pubalgia and FAI showed no dependence between variables ($p = 0.3952$). Twenty percent of athletes had pubalgia, while 65.6% did not, as shown in ►**Fig. 6**.

Discussion

This study analyzed 90 athletes aged 17 to 38, with an arithmetic average of 26 years old. The age group with the highest FAI proportion was 25 to 29 (34.4%), followed by 20 to 24 (28.9%). Gerhardt et al.[9] observed similar findings in a study with professional football players, in which most subjects were 20 to 29 years old, with an average of 25.4 years old.

Most players from our sample were right-handed (61.1%) and had adequate weight according to their BMI (73.3%). Regarding the orthopedic physical examination, 70% of the players presented a positive Trendelenburg sign (70%), mostly bilaterally. Such data exemplifies the typical age range of Brazilian professional football players.

Our series diagnosed pubalgia in 22 players (24.4%). During the orthopedic physical examination, the main signs were painful groin palpation, followed by pain in the adductor muscles. Mercurio et al.[10] also found a similar prevalence of pubalgia in football athletes, with 24.3% affected subjects, demonstrating a predominance in professional players.

This study observed the high FAI prevalence in this population (85.6%). Furthermore, the CAM-type impingement was the most frequent (62.2%), with a statistically significant difference compared with the PINCER (4.4%) and the mixed type (18.9%). Such features are consistent with high-performance athletes. Economopoulos et al.[11] studied 56 athletes complaining of pubalgia and found an FAI prevalence rate of 86%, with a predominance of CAM-type injuries, corresponding to 83.7% of cases.

Gerhardt et al.[9] observed that 51 out of 75 male soccer players had radiographic evidence of FAI, of which 68%

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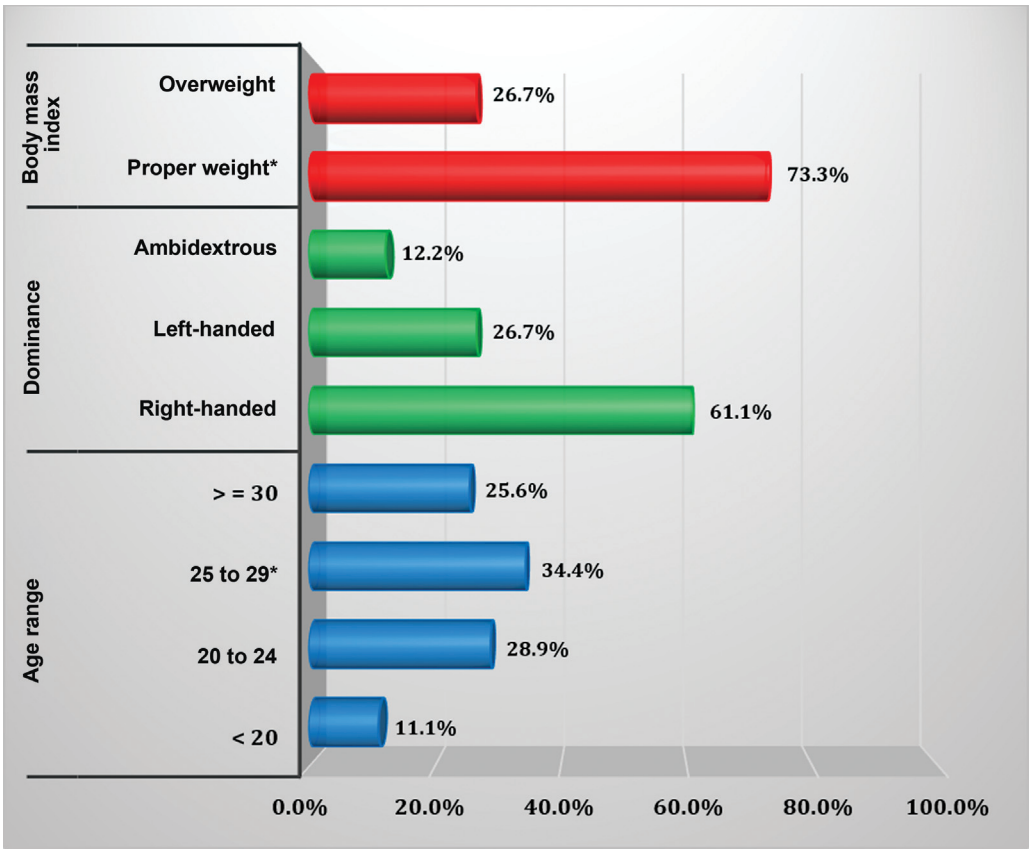

Fig. 1 Profile of the players from the sample, 2022. Source: Form completed during the athletes' evaluation.

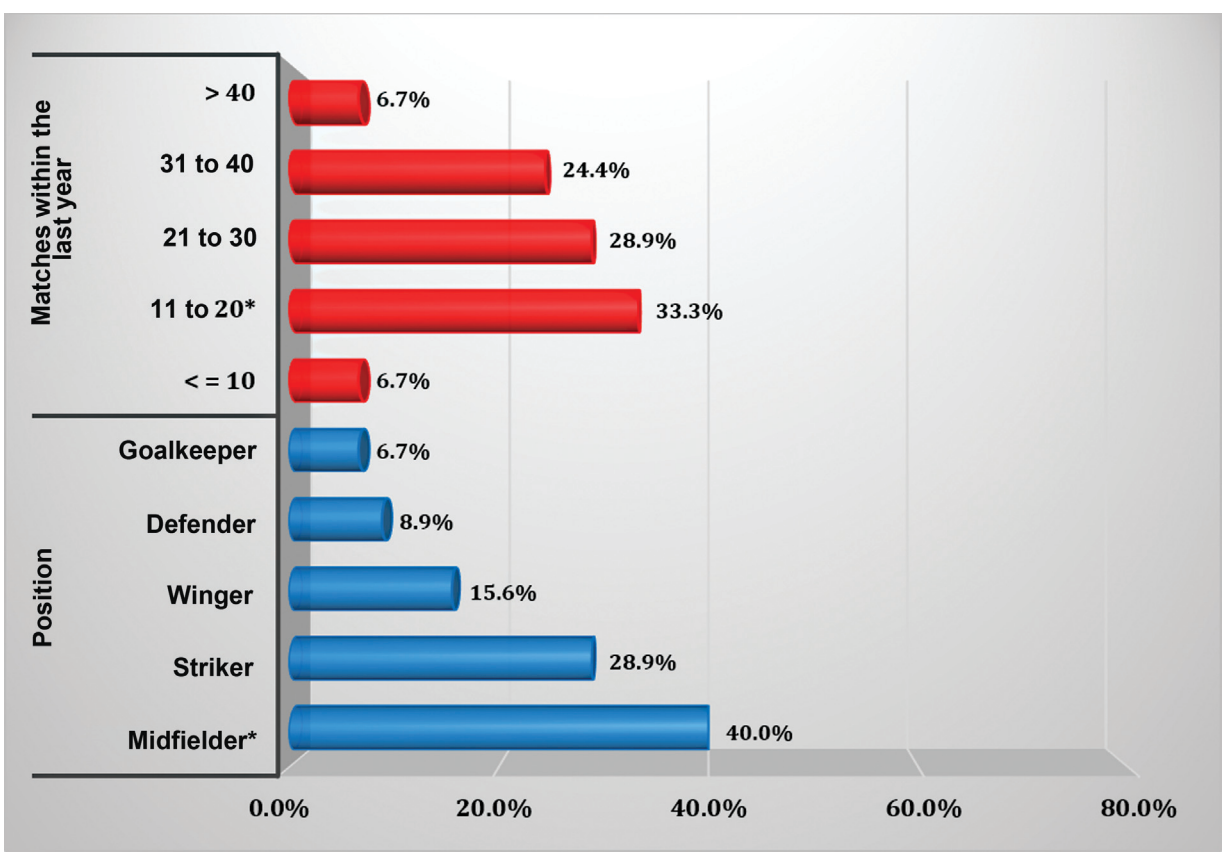

Fig. 2 Profile of the players from the sample, 2022. Source: Form completed during the athletes' evaluation.

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Table 1 Trendelenburg sign in players, 2022

Variables	Athletes	%
Trendelenburg sign		
Present*	63	70.0%
Absent	27	30.0%
Location		**N = 63**
Right side	5	7.9%
Left side	21	33.3%
Both sides	37	58.8%

Source: Form completed during the athletes' evaluation.
*p = 0.0002 at the chi-square adherence test.

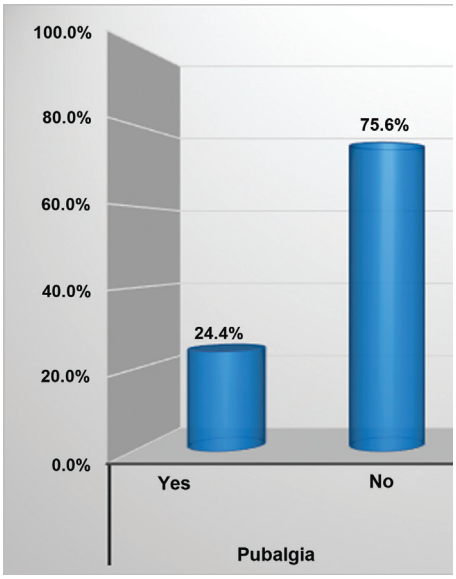

Fig. 3 Patients diagnosed with pubalgia, 2022. Source: Form completed during the athletes' evaluation. *p < 0.0001 at the chi-square adherence test.

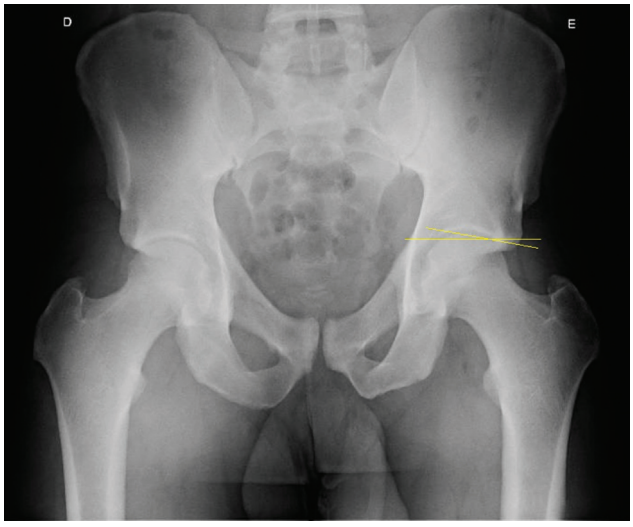

Fig. 4 Anteroposterior pelvic radiograph showing pincer-type impingement (Tönnis angle = -7°). Source: Form completed during the athletes' evaluation.

Table 2 Femoroacetabular impingement in players, 2022

Variables	Athletes	%
Femoroacetabular impingement		
Present*	77	85.6%
Absent	13	14.4%
Femoroacetabular impingement type		
CAM*	56	62.2%
Pincer	4	4.4%
Mixed	17	18.9%
Alpha angle		
With impingement*	72	80.0%
Without impingement	18	20.0%
Tönnis angle		
With impingement*	21	23.3%
Without impingement	69	76.7%
Pistol grip deformity		
Present*	11	12.2%
Absent	79	87.8%
Wiberg angle		
No impingement	90	100.0%

Source: Form completed during the athletes' evaluation.
*p < 0.0001 at the chi-square adherence test.

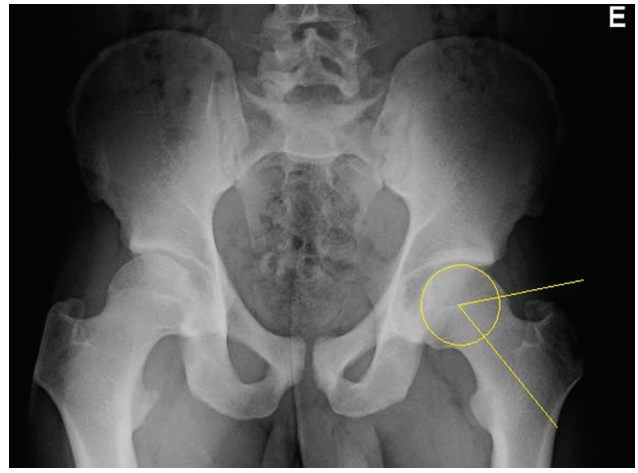

Fig. 5 Anteroposterior pelvic radiograph showing CAM-type impingement (pistol grip deformity, alpha angle = 62°). Source: Form completed during the athletes' evaluation.

(51/75) were CAM-type injuries, including 39 with bilateral injuries. Twenty out of 75 athletes had PINCER-type lesions, with 80% of bilateral injuries. These findings are consistent with our study, corroborating that professional football athletes are at risk for developing bilateral femoroacetabular joint injuries, resulting from characteristics inherent to the sport, the young age when started playing professionally, and the cumulative injury effect related to matches with a high competitiveness level.[9]

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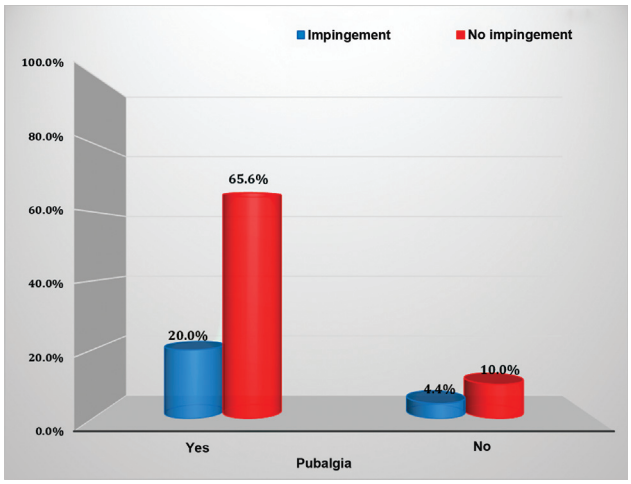

Fig. 6 Relationship between pubalgia and femoroacetabular impingement, 2022. Source: Form completed during the athletes' evaluation.

Other authors addressing this topic were Falotico et al.,[12] who studied FAI prevalence in male football players in comparison with non-athlete men. These authors observed an FAI rate of 92.5% in athletes and 28.1% in non-athletes, corroborating the strong influence of sport on the emergence and maintenance of these abnormalities. This high prevalence occurs because, in Brazil, people start playing sports at a very early age; in addition, players do not always practice the sport on suitable fields or with adequate equipment and supervision. The study also showed a positive relationship between the length of a sports career and the alpha angle.[12]

Futhermore, Lee et al.[7] studied FAI changes in young athletes and demonstrated that of the 156 hips studied, 86 (55.1%) had CAM-type, 43 had pincer-type (27.6%), and 27 had mixed-type FAI, consistent with our study showing the prevalence of CAM-type lesions in athletes.

Moreover, it is critical to highlight that CAM-type injuries are related to high-intensity movements, especially those involving abnormal contact between the acetabulum and the femoral head during hip flexion and internal rotation.[6] Such features corroborate this finding as the most prevalent in the elite athlete population, as demonstrated in this study.

Regarding the radiographic evaluation of FAI-suggestive signs, athletes with a positive alpha angle presented an angle greater than 55°. Our study detected a high prevalence of positive alpha angle, corresponding to 80% of the studied athletes. The Tönnis angle had the second highest proportion (23.3%), and no player had abnormal Wiberg angles. Such data agree with the findings of Gerhardt et al.[9] demonstrating a positive alpha angle in most players.

One of the most significant data from this study is the lack of a dependent correlation between pubalgia and FAI; only 20% of athletes complained of pubalgia, but this correlation was not statistically significant in the sample. Elattar et al.[6] described the coexistence of FAI and pubalgia as common in athletes, at a 32% rate, slightly higher than in our study.

Other authors, such as Strosberg et al.[13] and Munegato et al.,[14] reported the coexistence of FAI and pubalgia but did not perform clinical studies to prove such an association. Bisciotti et al.,[15] in a study with 44 patients with pubalgia, demonstrated a strong association between CAM-type injuries and inguinal conditions, disagreeing with our results. Therefore, further research is required to expand the knowledge about pubalgia associated with FAI in the athlete population.

Conclusion

We concluded that FAI is highly prevalent (85.6%) among professional football athletes, with a predominance of CAM-type impingement (62.2%); in addition, there was no relationship between FAI and pubalgia.

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Conflict of Interests
The authors declare no conflict of interests.

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